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FURNACE CONSTRUCTION AND CONTROL
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The object of my invention is to provide a furnace construction and control means therefor which are simple, durable and comparatively inexpensive to manufacture.

5 A further object is to provide a furnace so constructed that air circulation can be maintained but temperature in various rooms or zones of a building or the like may be accurately controlled by individual thermostats located in the various
10 zones, the control means being operable to vary the temperature of the air being circulated to the various zones rather than its volume.

Still a further object is to provide means for practically continuously circulating air through
15 rooms or the like in connection with a furnace of special construction from which both hot air and tempered air can be supplied, the various zones to which the air is supplied being each provided with an individual thermostat which deter-
20 mines whether hot air or tempered air shall be supplied to the zone, the determination, of course, being responsive to the temperature requirements of the zone, whereby to maintain the zone at an even temperature, the heat generator being auto-
25 matically controlled so as to operate when any one of the zones requires heat.

Still a further object is to provide a modified form of construction which will either circulate the air in the various zones without heating it, or
30 both circulate and heat it as required, depending on the temperature conditions of the various zones.

With these and other objects in view my invention consists in the construction, arrange-
35 ment and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

40 Figure 1 is a vertical sectional view through a furnace construction embodying my invention.

Figure 2 is an electrodiagrammatic view showing the furnace construction and various controls used in connection therewith.

45 Figure 3 is a diagrammatic view of a modified form of construction; and

Figure 4 is an electrodiagrammatic view showing a modified damper control for Figure 2.

On the accompanying drawing, I have used the
50 reference numeral 10 to indicate the body portion of a furnace. The body portion 10 has in it a combustion chamber or compartment 12 and a compartment 14 for ashes or automatic fuel burning mechanism. The usual heat radiator is pro-
55 vided, as indicated at 16, through which the

smoke or other products of combustion pass before entering the chimney in the ordinary manner. Specific details of this are not shown on the drawing as it comprises no part of my present invention.

Surrounding the body portion 10 of the furnace is an inner casing 18 having a cone-shaped head 20 and a restricted neck 22. Above the neck 22 and communicating with it a plenum chamber 24. Hot air conduits 26 lead from the plenum
10 chamber 24 to various rooms or other zones of a building. Only two of the hot air conduits 26 are illustrated, it being understood, of course, that any number desired can be used.

Surrounding the inner casing 18 is an outer
15 casing 28 having a reduced portion 30 and a restricted neck 32. A tempered air chamber 34 surmounts the restricted neck 32 and communicates with it, passageways 36 being provided for conducting air from the chamber 34 to the
20 conduits 26. The air flowing between the casings 18 and 28 is indicated by dotted line arrows and may be called "tempered air".

A cold air shoe is illustrated at 38. Within it a blower housing 40 is provided having inlet open-
25 ings 42. A blower rotor is indicated at 44, while the outlet for the blower is indicated at 46.

The outlet 46 communicates with the outer casing 28, while the inner casing 18 is provided with an opening 48 in substantial alignment with 30 the outlet 46 but spaced from it as clearly shown.

It is thus possible for part of the air from the blower to pass between the combustion compartment 12 and the casing 18 and part through the space between the casings 18 and 28, the casing
35 18 being provided with openings 50 spaced circumferentially around it for the purpose of permitting the air from the blower to be distributed to the tempered air space.

A cold air pipe 54 leads from the various rooms 40 or zones to which the hot air conduits 26 lead. A pipe 56 can be provided for taking in a small regulated amount of outside air so as to maintain a slight pressure in the zones to be heated for causing outward rather than inward leakage
45 flow. A pipe 58 drops from the pipes 54 and 56 to the cold air shoe 38.

Automatic damper motors 60 and 60a are provided, having damper shafts 62 and 62a provided with dampers 64 and 64a. Where additional
50 pipes 26 lead from the plenum chamber 24, additional damper motors and dampers are provided.

It will be noted that the dampers 64 and 64a are adapted to close either communication from the plenum chamber 24 to the hot air pipe 26
55

or from the tempered air chamber 34 to the pipe.

For automatically controlling the damper motors 60 and 60a, I provide room thermostats 70 and 70a, each located at an advantageous point in the zone to which its respective hot air pipe leads. The thermostats may be of the three wire type for causing rotation of the damper motors in either one direction or the other, or of the two wire type when the damper motors are of the automatic return type.

The current for the motors 60 and 60a is preferably low tension and can be supplied from a transformer 72 or any other suitable source of power.

As shown in Figure 2, current supply wires extend "to heat plant". These may control an automatic coal stoker, automatic gas or fuel oil burners or the like. The heat plant may be termed as a heat generator for the purpose of my claims wherein the term refers to the furnace and the casing 18 within which the air is heated.

It is desirable to control the heat generator from each thermostat so that when any one thermostat calls for heat, the heat generator will be operative. Provision can be made for this by providing on the damper motor 60, contacts 66 and 68 engageable when the room thermostat 70 is in cold position and cause the damper to swing to hot air position rather than its normal tempered air position. The damper motor 60a is likewise equipped with contacts 66a and 68a.

If it is desirable, as for instance when the damper motor operates slowly, to close the heat generator circuit immediately upon commencement of the damper from normal position to hot air position, the contacts can be arranged as in Figure 4 wherein the damper motor holds the contacts separated when in tempered air position, but immediately allows them to close when it starts to move toward hot air position.

Although it is desirable to maintain circulation of tempered air when any particular zone is not requiring hot air, the furnace can be constructed so that the air already in the zone can be circulated without being tempered, Figure 3 showing such a construction. In this figure, instead of using the casing 28, a conduit 28a is provided through which the air, without being tempered, can flow from the blower 40 to a cold air chamber 34a.

A "fan control" and a "limit control" are also preferably provided for the fan and the heat generator, respectively.

Practical operation

The thermostat 70 is in normal position, the heat requirements for the zone in which it is located being satisfied. The thermostat 70a is indicated in its heat requiring position whereby it has energized the motor 60a and caused the damper 64a to move to position for the flow of hot air to the zone for the thermostat 70a rather than tempered air, the contacts 66a and 68a being engaged for operating the heat generator. It will be noted that the limit control is in series with the contacts 66a and 68a. Accordingly, when the limit control reaches a predetermined high temperature, it will cut off the current to the heat plant, it being set for operation at about 140°. This prevents any overheating or "overrunning" of the heat generator.

When the heat requirements of the zone for

the thermostat 70a are satisfied, the thermostat will move to its opposite position for returning the damper 64a to its normal position.

It will be noted that in either position, the air is free to circulate, but its temperature is controlled by the position of the damper even though the volume of air remains the same. This is quite important to eliminate stratification of the air in the room and prevent what is known as "cold 70".

The blower 44 is not an essential part of my invention as the invention can be applied to gravity circulation as well as forced air circulation. In either case, the temperature of the air is controlled in the individual zones by supplying either tempered air or hot air thereto.

Although not as satisfactory, the construction of Figure 3 either re-circulates the air or both heats and re-circulates it, thus providing continuous circulation, although not as good and efficient temperature control for the individual zones.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a device of the class described, a heat generator for a plurality of zones, hot air conduits from said heat generator to said zones, means for continuously maintaining circulation of air from and to said zones and through said hot air conduits, a means responsive to the temperature of each zone for controlling the temperature of the air supplied from the hot air conduits to the zones and means for controlling said heat generator, said last means being operable to cause the heat generator to operate when any of said means responsive to the temperature of each zone is in position for raising the temperature of the air supplied from the hot air conduit to that zone.

2. In a device of the class described, a heat generator for a plurality of zones, hot air conduits from said heat generator to said zones, means for continuously maintaining circulation of air from and to said zones and through said hot air conduits, damper means movable to cause the circulated air to pass through the heat generator or by-pass it and means for controlling said heat generator, said last means being operable to cause operation of the heat generator only when one or more of said damper means is in position causing the circulated air to pass through said heat generator.

3. In a device of the class described, a heat generator for a plurality of zones, hot air conduits from said heat generator to said zones, means for continuously maintaining circulation of air from and to said zones and through said hot air conduits, damper means each movable to control circulated air to cause it to pass through said heat generator or by-pass it, means for controlling said heat generator, said last means being operable to cause operation of the heat generator only when one or more of said damper means is in position causing the circulated air to pass through said heat generator, each damper means being only responsive to the temperature of the zone, the air for which it controls.

4. In a device of the class described, a heat generator for a plurality of zones, a casing therearound and spaced therefrom, hot air conduits from said heat generator to said zones, means for

continuously maintaining circulation of air from and to said zones and through said hot air conduits and damper means movable to cause the circulated air to each zone to either entirely pass between the outer surface of said heat generator and said casing or to entirely pass over the outer surface of said casing.

5 In a device of the class described, a heat generator for a plurality of zones, a casing there-
10 around and spaced therefrom, hot air conduits from said heat generator to said zones, means for continuously maintaining circulation of air from and to said zones and through said hot air
15 conduits and damper means movable to cause the circulated air to each zone to either entirely pass between the outer surface of said heat generator and said casing or to entirely pass over the outer
20 surface of said casing, one damper means being provided for each zone and controlled in response to the temperature thereof.

6. In a device of the class described, a heat generator for a plurality of zones, a casing there-
25 around and spaced therefrom, hot air conduits from said heat generator to said zones, means for maintaining circulation of air from said zones over the outer surface of said heat generator or
30 over the outer surface of said casing and through said hot air conduits back to said zones and means responsive to the temperature of each zone for controlling the flow of the air to cause it to
either pass over the heat generator or over the casing.

7. A furnace construction comprising a combustion compartment, a hot air chamber there-
35 around, a tempered air chamber around the hot air chamber, conduits from the two chambers and means to control the flow of air from the two chambers to each of said conduits, causing
40 the air to each one to flow from either chamber to the exclusion of flow from the other one.

8. A furnace construction comprising a combustion compartment, a hot air chamber there-
45 around, a tempered air chamber around the hot air chamber, conduits from the two chambers, damper means to control the flow of air from the two chambers to the conduits and a temperature responsive means located in the zones to which
the conduits lead, to control each damper means

for the respective zones and thereby cause individual flow of either hot air or tempered air only to each zone.

9. A furnace construction comprising a combustion compartment, a hot air chamber there-
5 around, a second chamber around the hot air chamber, conduits from the two chambers and means to control the flow of air from the two chambers to said conduits and thereby cause in-
10 dividual flow of either hot air or tempered air only to each zone.

10. A furnace construction comprising a combustion compartment, a hot air chamber there-
around, a second chamber around the hot air
15 chamber, conduits from the two chambers, damper means to control the flow of air from the two chambers to the conduits and a temperature responsive means, located in the zones to which the
20 conduits lead, to control each damper means for the respective zones and thereby continuous in- dividual flow of either hot or tempered air only to each zone.

11. In a device of the class described, a heat generator for supplying heat to a plurality of
25 zones at a plurality of different temperatures, a control means therefor, hot air conduits from said heat generator to said zones, a blower for maintaining circulation of air from said zones and
30 through said hot air conduits back to said zones and means responsive to the temperature of each zone for controlling the temperature of air supplied to the respective hot air conduits by causing
supply at various of said temperatures and to control said first control means.

12. In a device of the class described, a heat
35 generator for supplying heat to a plurality of zones at a plurality of different temperatures, hot air conduits from said heat generator to said zones, a blower for maintaining circulation of
40 air from said zones and through said hot air conduits back to said zones, damper means movable to cause the circulated air to be supplied at one or another of said temperatures and means responsive to the temperature of each zone for
45 controlling said damper means and thereby the temperature of air supplied from the respective hot air conduits.

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